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PRINCETON UNIVERSITY
Department of Astrophysical Sciences
Princeton, NJ 08544

FINAL REPORT

GRANT NAG 5-1769

MODEL ATMOSPHERE ANALYSIS OF SELECTED LUMINOUS B STARS

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Edward L. Fitzpatrick

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P.I.: Edward L. Fitzpatrick

The general scientific goal of this program has been to determine whether the atmospheric structure of the B-type stars can be represented by the current generation of plane parallel, line-blanketed, LTE stellar atmosphere models sufficiently well to allow accurate effective temperatures and surface gravities to be deduced. The B stars cover a wide range of temperature and luminosity. For the hottest such stars (with $T \sim 30,000$ K) the applicability of the models may be compromised by departures from LTE in the stellar atmospheres ("non-LTE effects"). At the highest luminosities (the B "supergiants"), the models may be invalidated by departures from plane parallel geometry. Thus we seek to identify the temperature and luminosity range within which these effects are unimportant and where the models may be relied upon.

Along with co-investigators Massa (Applied Research Corporation) and Walgren (Computer Sciences Corporation), our approach to the problem is to test whether the models can simultaneously reproduce the continuous energy distributions of the stars as well as their detailed spectral line intensities. The general distribution of labor among the investigators is for Fitzpatrick to compute a grid of atmosphere models using a program obtained from R.L Kurucz (Smithsonian Astrophysical Observatory); for Massa to determine nominal temperatures and gravities for a set of B stars covering the range of temperatures and luminosities expected for this class of stars through comparison of the theoretical continuous energy distributions with the observed (reddening-corrected) energy distributions of the stars (using optical photometry and low resolution IUE spectrophotometry); and for Walgren to produce the detailed synthetic spectra for comparison with high-resolution IUE short-wavelength SWP spectra.

The model calculations have been completed by Fitzpatrick and Walgren has set up the synthetic spectrum program ("SYNTHE"). Massa has performed an initial calibration of the temperatures and gravities of the B stars using the energy distributions. The final calibration of the energy distributions and the computations of the synthetic spectra have been delayed by the general reprocessing of the IUE Final Archives. We are waiting for the reprocesed IUE low-dispersion spectra before completing this project, in order to benefit from expected improvements in the IUE absolute flux calibration and in the corrections for time-dependent sensitivity changes. At the time of this report the IUE low-dispersion SWP images are nearly completely reprocessed. The long wavelength (LWR and LWP) images will be reprocessed next and it is expected that a procedure for requesting priority reprocessing of selected images will be in place shortly.